PERISCOPE: PERIapsis Subsurface Cave OPtical Explorer (PERISCOPE)

Completed Technology Project (2014 - 2015)

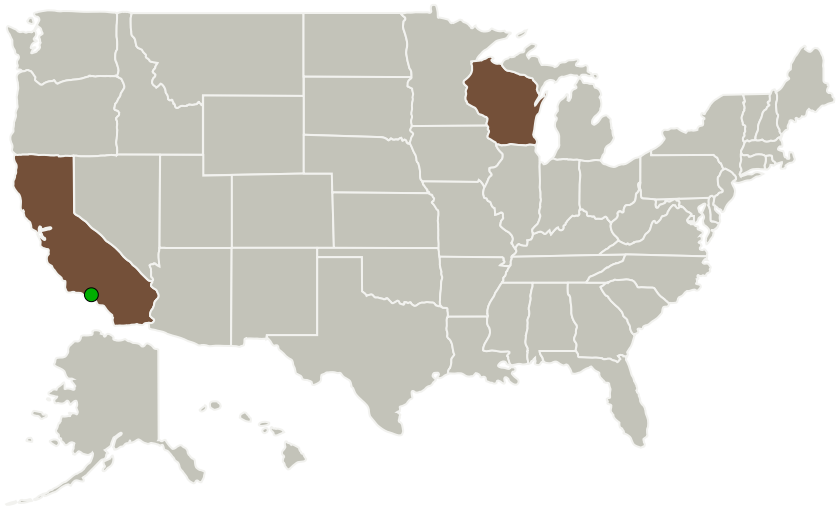
Project Introduction

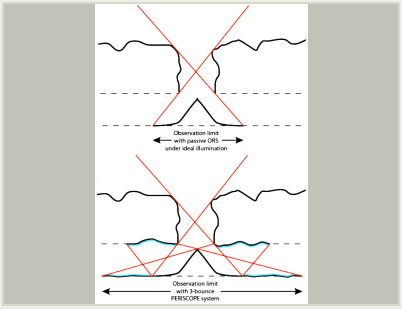
In this NIAC report we present a new technique enabling a practical option for mapping these structures at a relatively low cost: Photon Time-of-Flight (PTOF) imaging. Human beings will eventually have a continuous or permanent presence on the moon. Caves provide multiple benefits for future crewed missions: protection from the extreme temperature swings on the surface, the possibility of resources, and simplified local habitat construction using ready-made structure. PERISCOPE offers HEOMD a way to investigate both questions with one low-cost mission. Photon time of flight imaging can map the interior structures of lunar skylights and potentially characterize elemental distribution within the caves. Knowledge of ice distribution in various caves would be valuable for future crewed visits as both a possible source of consumables as well as fuel. The PERISCOPE concept can contribute significantly to the NASA SMD long-term goals of understanding our solar system and the bodies within it. The Earth's Moon is a particularly valuable target, because it preserves a record of exogenic processes in the Earth-Moon system, and thus the history of impacts (which wreaked havoc on early Earth.) Volatile deposition and space weather on the Moon has direct relevance to that on Earth. Due to its proximity, it is also a cost-effective target, and a likely staging post for human exploration of the Solar System.

Anticipated Benefits

This will allow the mapping and characterization of lunar subsurface structures.

Primary U.S. Work Locations and Key Partners





Technology concept diagram

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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Nosanov Consulting, LLC

Responsible Program:

NASA Innovative Advanced Concepts

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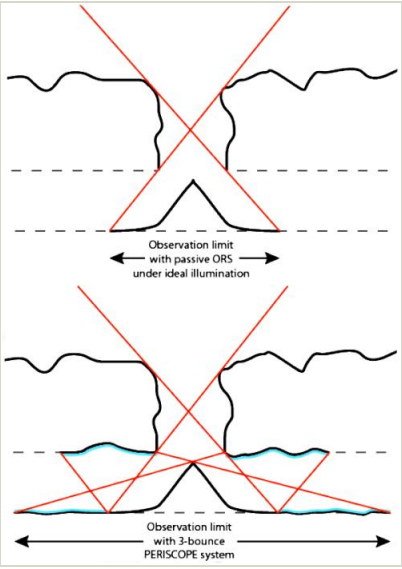
Organizations Performing Work	Role	Type	Location
Nosanov Consulting, LLC	Lead Organization	Industry	
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California
Morgridge Institute for Research	Supporting Organization	R&D Center	
University of Wisconsin-Madison	Supporting Organization	Academia	Madison, Wisconsin

Primary U.S. Work Locations	
California	Wisconsin

Images



PERISCOPE Concept
Technology concept diagram
(https://techport.nasa.gov/image/102257)

Project Management

Program Director:
Jason E Derleth

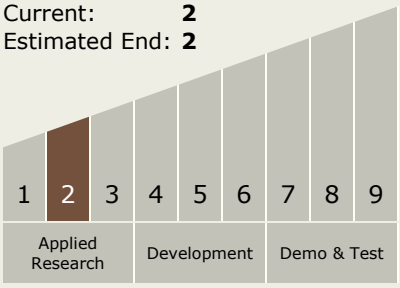
Program Manager:
Eric A Eberly

Principal Investigator:
Jeffrey P Nosanov

Co-Investigators:
Andreas Velten
Nitin Arora
Stephen F Dawson
Karl L Mitchell

Technology Maturity (TRL)

Start: **2**
Current: **2**
Estimated End: **2**



Technology Areas

Primary:

- TX07 Exploration Destination Systems
  - TX07.1 In-Situ Resource Utilization
    - TX07.1.1 Destination Reconnaissance and Resource Assessment

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Target Destination

The Moon